

CHAPTER 10

Surgical treatment: types of resection according to the location of the primary tumor

Right and left colon cancer

Right-sided colon tumors are more common in older women (sporadic), in patients with insulin resistance, and in patients with a family history of cancer and at a younger age. Right-sided colon tumors are more associated with serrated adenomas, sessile and flat polyps, mucinous adenocarcinomas, and more advanced tumors.¹⁻⁴ From a molecular point of view, they present a greater deficiency of DNA repair proteins (dMMR) and greater hypermethylation, especially in women. In addition, they are associated with greater resistance to epidermal growth factor receptor (EGFR) inhibitors, greater sensitivity to vascular endothelial growth factor (VEGF) inhibitors, and a higher rate of mutated BRAF and RAS.⁵⁻⁷

Left-sided colon tumors are generally sporadic and are related to dietary habits such as lack of fiber intake, alcohol consumption, and smoking. They are more frequent and are more associated with pedunculated polyps, tubulovillous adenomas, and typical adenocarcinomas. From a molecular point of view, they present mutations in the APC gene, lack of p53, and greater sensitivity to EGFR inhibitors. However, OS is similar in both groups.⁸

A SEER-based study reported that right-sided colon tumors in EI and EII had better OS and DFS than left-sided colon tumors at the same stages, although no differences were found in EIII.⁹ Although evidence may be conflicting on this issue, in general right-sided colon tumors in EI and EII have a better prognosis than left-sided ones, whereas in EIII and EIV they are associated with a worse prognosis.^{3,4,7,8}

The difference in survival and risk of death in patients treated with adjuvant therapy (more frequent in right-sided tumors) between 1992 and 2005 was analyzed, studying 23,578 patients in EII and 17,148 patients in EIII (Table 10.1). Chemotherapy for tumors in EII was received by 18% of patients with right-sided tumors and 22% with left-sided tumors. The 5-year survival benefit was only observed in EIII, regardless of tumor location (HR RC 0.64 vs. HR LC 0.61). This study considers that adjuvant therapy in EII should be reserved for older patients.^{10,11}

Table 10.1. Difference in 5-year survival rate, according to tumor side for stages II and III.

Period of time	Right colon	Left colon	P value
1980-1989	Equal	Equal	NS
1990-1999	56%	59%	< 0.01
> 2000	67%	71%	< 0.01

The difference in 5-year survival varies between the right and left side, probably due to variation in tumor biology (MSI and KRAS and BRAF mutations), although some authors postulate differences between the type and quality of surgery, related to the greater complexity of surgery on the right side and the better performance of an extended surgery on the left side. Several studies addressed the important relationship between modifications in surgical technique (e.g. introduction of TME) and the substantial improvement in oncological evolution and clinical results.¹²

Extended mesocolon resections with lymph node dissection, aim to improve oncologic outcome. An evaluation of 2052 articles found that the risk of developing central lymph node metastatic involvement in right-sided tumors ranges from 1 to 22%. In sigmoid tumors, the risk is less than 12% and is associated with advanced T stages.¹³

The group from the Hospital Italiano of Buenos Aires compared 292 patients with right colon tumors and 255 with left colon tumors, operated on by laparoscopy between 2004 and 2014. Patients with right tumors were older (71 vs. 65 years), with more ASA 3 and 4 (36 vs. 26%), and had a higher percentage of women without intraoperative complications (4.1 vs. 5.9%), higher conversion rate (6 vs. 3.9%) and more postoperative complications related to surgery (61 vs. 48%). Right colectomy had a shorter operative time (162 vs. 185 min) (Table 10.2), but higher overall morbidity (20.5 vs. 13.3%) and postoperative ileus (10.6 vs. 2.4%), and longer hospital stay (4.7 vs. 3.9 days), with no differences in reoperations, readmissions, and mortality. On multivariate analysis, right colectomy was associated with shorter operative time, higher ileus, and longer hospital stay.¹⁴

Table 10.2. Differences in operative time between right colectomy (RC) and left colectomy (LC).

Operative time	RC	LC	P value
All cases	162	185	0.001
With splenic flexure mobilization	161	166	0.38
Without splenic flexure mobilization	166	201	0.001

Tumors of the right and left colon are two distinct entities and treatment must be adapted to each case, depending on the molecular phenotype, age, location and stage.

Type of resection

Right colon

Right colectomy is the standard surgical treatment for any tumor located in the cecum, ascending colon, hepatic flexure, and proximal transverse colon. Section of the ileocolic pedicle and the right branch of the middle colic artery at its origin is recommended, along with treatment of the mesocolon and lymphadenectomy.

Resection of the mesocolon with specific technique and the type of lymphadenectomy according to location will be discussed separately.

Left colon

For the treatment of tumors located in the descending colon, sigmoid colon and rectosigmoid junction, left colectomy is the standard. For this purpose, section of the superior rectal artery and the left colic artery at their origin is recommended, together with section of the inferior mesenteric vein at the lower border of the pancreas, and together with lymphadenectomy corresponding to this territory.

Transverse colon

In the transverse colon, resection should be individualized based on careful inspection of the tumor location and its feeding vessel, as well as considering the functional results of surgery at this site. There is controversy over whether segmental resection, extended right colectomy, or extended left colectomy should be performed in tumors located on the left side of the transverse colon, although the latter option is less discussed. This topic will be discussed in a separate section.

A 2019 meta-analysis of patients with transverse colon cancer indicated that the short- and long-term outcomes of segmental colectomy or extended right or left colectomy are similar.¹⁵

In 2020, an Italian national study found that segmental resection had fewer postoperative complications, including less anastomotic dehiscence (2 vs 4%) and better 3-year DFS (86 vs 78%), both differences with statistical significance.¹⁶

In 2021, a National Cancer Database study on transverse colon cancer EI, EII and EIII found a similar 5-year survival between segmental and extended colectomy (40.7 vs. 41.3%), although after multivariate analysis, extended colectomy was associated with lower survival (HR 1.07; 95% CI 1.04-1.10; $p < 0.001$).¹⁷

Splenic flexure

Tumors of the splenic flexure usually involve the lymphatic vessels of the pedicle of the left colic artery. However, positive lymph nodes have been identified along the middle colic, right colic, and occasionally ileocolic arteries in up to 9% of cases.¹⁸ Evidence based on retrospective studies and meta-analyses suggests that segmental resection is a reasonable alternative to extended colectomy.¹⁹

In the Delphi Consensus for the investigation and management of splenic flexure cancer, 18 experts from 12 countries voted on different aspects, based on the background that treatment remains controversial. There was moderate consensus (55%) regarding the definition, which includes the 10 cm segment on either side from where the transverse colon becomes the proximal descending colon, and on the recommendation of CT for localization (72%). Segmental colectomy was the preferred elective treatment (72%), with moderate consensus regarding CME with central vascular ligation (74%). Strong consensus was only achieved on the use of minimally invasive surgery for the surgical approach (88%).¹⁸

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